Operating manual

for MELAG-Autoclaves

Type 15 Type 17 Type 23

Dear Doctor:

Thank you very much for the trust which you have shown by purchasing this autoclave.

For 50 years now, MELAG - a medium-sized family-owned and -operated company - has specialised in the production of **sterilization** equipment for medical practice. During this period, MELAG has succeeded in becoming a leading manufacturer of **sterilization** equipment. More than 335 000 MELAG units sold throughout the world testify to the exceptional quality of our products, which are manufactured exclusively in Germany.

As all other MELAG products, this autoclave was manufactured and tested according to strict quality criteria. Before placing this unit into operation, please read this Operating Manual carefully. The long-term functional effectiveness and the preservation of the value of your autoclave will depend on careful preparation of instruments before **sterilization**, and on proper care of the unit.

The staff and management of MELAG

CE 0124

To ensure the functional effectiveness of this unit and to preserve its value:

1. Prepare the instruments to be sterilized carefully
2. Take proper care of the autoclave
3. Use only pure distilled or demineralised water

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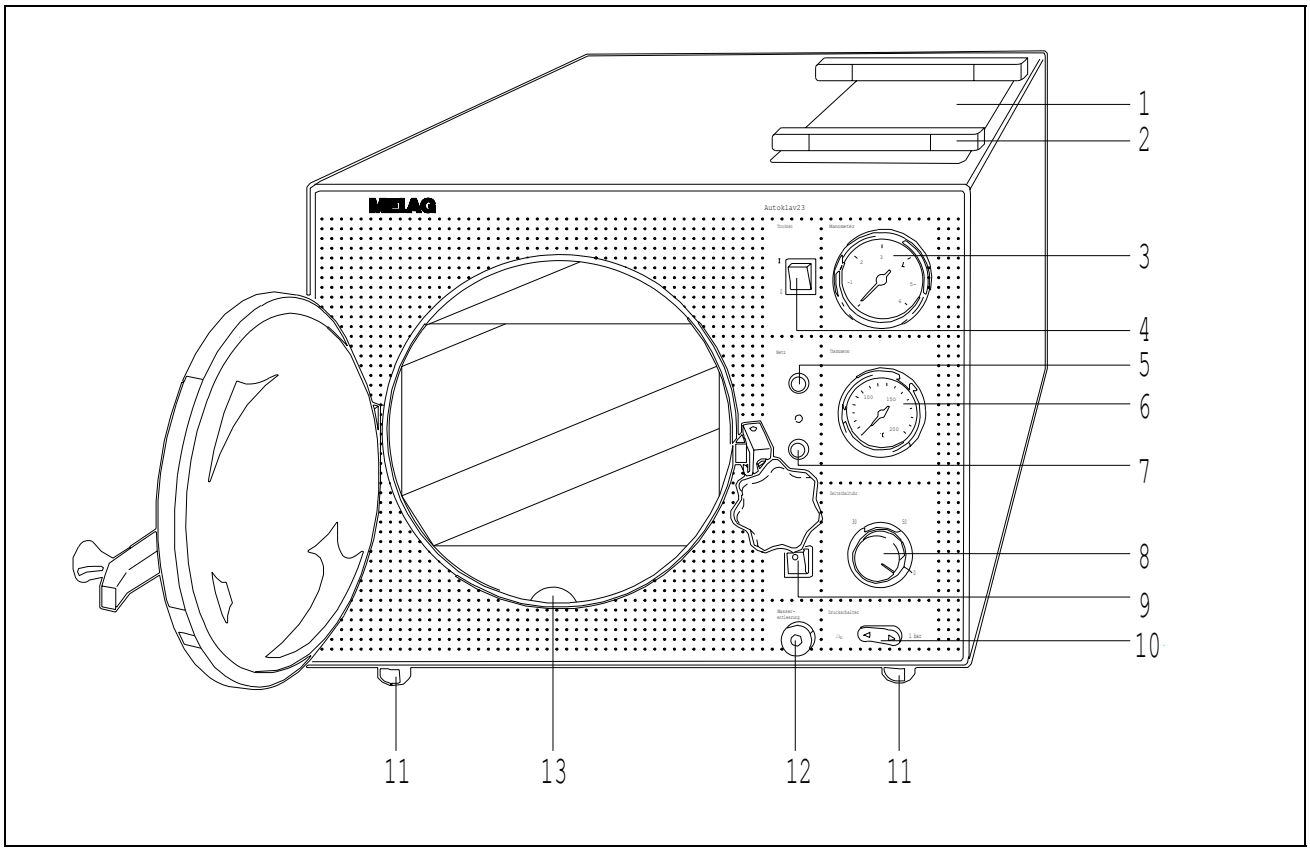
1 Introduction

1.1 Front of the autoclave



1 Housing lid
2 Cooling rests (for trays, etc.)
3 Pressure gauge
4 Switch "Drying"
5 Signal lamp "Power"
6 Thermometer
7 Signal lamp "Heating"
8 Timer switch
9 Switch "Water inlet"
10 Pressure selection
11 Adjustable feet
12 Outlet for draining distilled or demineralised water
13 Inspection cut-away for examining the water level

1.2 Technical data

		Type 15	Type 17	Type 23
Sterilization chamber (diameter X depth)		15 X 38 cm	18 X 42 cm	23 X 45 cm
Max. load:				
Instruments (with trays)		2 kg	3 kg	4 kg
Textiles		150 g	200 g	500 g
Electrical power supply, (AC)		230 V / 1560 W	230 V / 1350 W	230 V / 1970 W
Water consumption per sterilization cycle		280 ml	300 ml	300 ml
Pressure range:	1 bar program	-	1.0 bar (121°C) up to 1.4 bar (126°C)	
Pressure range:	2 bar program	2.0 bar (134°C) up to 2.5 bar (138°C)		
Operating time:	1 bar program	-	50 minutes	50 minutes
Operating time:	2 bar program	30 minutes	30 minutes	30 minutes
Break between 2 sterilization cycles		30 minutes	30 minutes	30 minutes
Mains-fuse 2x		12,5A/T	12,5A/T	12,5A/T
Drying time		As required		

1.3 Preparing instruments for sterilization

MELAG - non-rusting materials

All parts of MELAG autoclaves which come into contact with steam are made of non-rusting materials. The pressure chamber, storage container, and tray rack assembly are of stainless steel, pipes carrying steam are made of copper, the chamber door is made of chrome-plated brass, and the trays are made of eloxated aluminium.

Drag-in rust

The use of non-rusting materials excludes the formation of rust as a result of the components of the autoclave. Where rust forms in the autoclave or on the items being sterilized, investigations have repeatedly shown that this rust has been brought in from other sources. It should be borne in mind that rust can form even on the best quality stainless steel instruments, for example as a result of improper treatment with chemical agents or disinfectant during preparation for sterilization.

Preparations of items for sterilization

The example of drag-in rust shows how important it is to prepare items properly for sterilization. In particular, the following points should be observed: The instruments should be disinfected and cleaned immediately after use in accordance to UVV/VBG 103 with a disinfectant and/or cleaning solution. The solutions should be used in the correct concentration and care should be taken to adhere precisely to the correct immersion times! It is advisable to make use of appropriate cleaning aids such as an ultrasound cleaning unit, or a thermo-desinfector.

Cleaning the instruments before sterilization is also very important in order to avoid introducing dirt and contamination which can separate from the instruments under steam pressure and block the filters, jets, and valves of the autoclave! Above all, locks, joints and hinges of instruments must be thoroughly cleaned with a brush. Cleaning and disinfecting agents should be washed off thoroughly with clear water, again using a brush. Residues of cleaning and disinfectant chemicals must under no circumstances find their way into the autoclave, since they can give rise to corrosion! Finally, swill with demineralised water and then dry the instruments well.

Brand-new instruments

The cleaning procedures described above are also necessary for brand-new instruments, since these often carry small amounts of oil, fat and soiling from the manufacturing process.

1.4 Rust formation = Drag-in rust

As already explained, the non-rusting materials used in the autoclave cannot give rise to rust formation in the autoclave!

Where rust forms this is "drag-in rust". This originates from instruments or other metallic objects carrying traces of rust, even though they are made of stainless steel, or are made of normal steel but have a damaged galvanic coating. Often a single rusty instrument is enough to pass rust on to other instruments or to lead to film rust forming in the autoclave and resulting to corrosion damage. Therefore the pressure chamber should be wiped out regularly, in order to avoid the formation of film rust. Rust which forms on the pressure chamber, storage container, or on the tray rack assembly must be removed using small amounts of a mild commercial cleaning agent for stainless steel. Do not use steel wool or a steel brush! In order to clean the pressure chamber withdraw the tray rack assembly. Dispose of instruments which are causing rust!

1.5 Taking care of your autoclave

Every week

Cleaning the autoclave chamber

The autoclave chamber and the door surfaces should be cleaned at least once a week. To do this, the trays and the tray rack assembly should be withdrawn from the chamber. The chamber can then be wiped out with a soft cloth or a (non-abrasive) sponge. Stubborn spots can be removed using small quantities of a mild commercial steel cleaning agent, taking care that none gets into the pipes attached to the autoclave chamber. Do not use abrasive cleaners such as steel wool or a wire brush. Alkaline cleaning agents or products containing chlorine alkaline must not be used. Spots on stainless steel can be removed using 5% oxalic acid.

Door gasket

The door gasket should be checked once a week for signs of wear and damage. It should be cleaned with a mild commercial cleaning agent.

Every two weeks

Demineralized/distilled water storage container

Every two weeks, the demineralised/distilled water storage container should be emptied by opening the outlet (12). If necessary clean the container, e.g. using a bottle cleaning brush and warm water with a detergent additive. Swill out well with water and refill with demineralized/distilled water (for the water quality see Section 4.2).

Note!

Door spindle

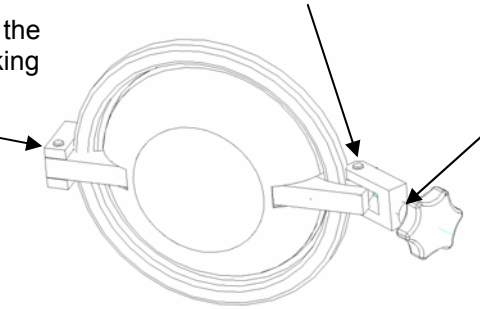
The spindle of the door lock is important for the safe operation of the autoclave, **and must be regularly lubricated with silicone grease**. Any signs of wear should be reported immediately to an authorised technician, who will examine and if necessary replace it.

1.6 Instructions for inspection and care of the door and door-lock components

In order to prevent premature wear, it is absolutely necessary to keep the following components well lubricated at all times: the threaded spindle of the palm grip hand knob, the hinges of the lock yoke, and the pressure locking bar. Use the following lubricant: plain-bearing grease (*Gleitfett*, MELAG art. no. 24355), or an equivalent silicone grease, or Molykote®.

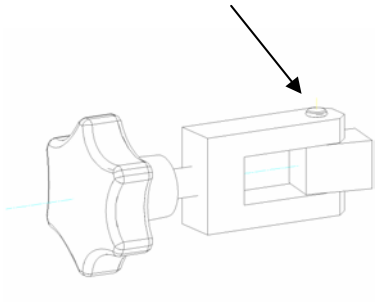
The signs in the diagrams below indicate that the lock components of the door have become subject to excessive wear. If any of the following signs appear, then the device must be inspected by a MELAG customer-service representative, or an authorized technician from a specialist dealer:

- There is too much play in the hinge of the pressure locking bar (the door "hangs")
- There is too much play in the hinge of the lock yoke.
- Too much play in the threaded spindle of the palm grip hand knob (the spindle rattles in the latch)
- The threaded spindle become definitely hard to turn

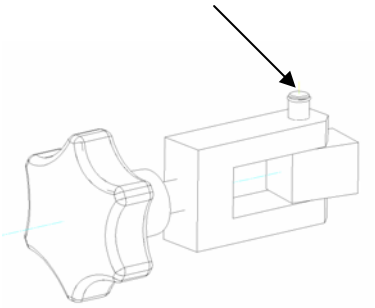


- Hard-metal screw-thread insert which has been screwed out of the latch

Warning!
The hinge bolts must absolutely remain completely inserted (flush) in the latch and in the hinge yoke of the locking pressure bar (left side)



Warning!
If the bolt moves out of place upward or downward as shown here, and is not flush, do not use the autoclave. Call the technical customer service for repair before using the device.



1.7 Checking the autoclave

Regular check

The operator of the autoclave can use the control instruments and the sterilization times as a check that the sterilization is effective. In Program 2 bar the pressure gauge should show between 2 and 2.1 bar (*or for 1 bar between 1 and 1.1 bar*) for at least 5 minutes (*20 minutes*) and at the same time the thermometer should read 134 to 135°C *(120 to 121°C*).

Periodical check (every half year)

DIN 58 946 Part 8 Section 3.2 recommends:

"The periodical inspection shall be carried out in situ at regular intervals, e.g. every six months. This shall establish that the small sterliser when used in accordance with the operating instructions sterlises properly."

Hygiene Institutes and other official medicinal test laboratories are able to supply test spores, evaluate these after sterilization, and provide confirmation of the results on a test certificate.

In accordance with DIN 58 946 Part 4 and DAB 10 (*Deutsches Arzneimittelbuch*) the testing of steam-autoclaves shall be carried out with spores of "**Bacillus Stearothermophilus**" (e.g. ATCC 7953, Paper Spore Strips, Oxoid, Cd. No.: BR 23).

For the MELAG Types 15, 17 and 23 (chamber volume >5 dm³), DIN 58 946 Part 8 specifies the use of five bioindicators (plus one positive control sample).

Prepacked test spores (e.g. spore strips in packed in paper, or test tubes, e.g. "Attest") shall **not be packed again before being placed in the autoclave**.

Note:

If the spores are contained in a tube which only has perforations at one end (e.g. "Attest", 3M, which has the perforations in the brown end cap), then this should never be placed in the autoclave so that the perforations are on top. The autoclave works using gravitation drainage, so the perforations should be at the bottom, or at least on the side, as is the case if the tubes are laid in the autoclave.

If you receive "hand made" spore samples, which have already been sealed in a paper-foil packaging, then care must be taken that the steam has full access to the paper side of the packaging. As above, the items to be sterilized should be placed in the autoclave with the paper either facing downwards or to the side.

2 Installation

2.1 Setting up the autoclave

Space requirements

The autoclave must be installed at least 10 cm away from an adjacent wall or upright surface on each side. The clear space above the autoclave shall be at least 30 cm. The correct positioning of the autoclave is very important for good sterilization results. The installation, and reinstallation if the autoclave is moved to another position, should be carried out with great care.

Setting up correctly - horizontally

This MELAG autoclave is filled directly with water. This convenient feature requires that the autoclave is set up horizontally on a flat, stable surface. The chamber is installed in the autoclave at a slight angle so that the distilled / demineralised water can only be seen in the inspection cut-away (13) when the necessary quantity of water has been filled in the chamber.

Setting up incorrectly - "sloping forward"

However, if the surface on which the autoclave has been installed slopes forward, then the distilled or demineralised water will already be visible at the inspection cut-away before the necessary amount has been introduced into the chamber. This means that there will not be enough distilled or demineralised water to reach the required pressure in the chamber, and the pressure of 2 bar will not be reached and held for approx. 5 minutes, or the constant pressure of 1 bar will not be maintained for the necessary 20 minutes.

Setting up incorrectly - "sloping backward"

If the autoclave is set up on a surface that slopes backwards, then too much distilled or demineralised water will be filled into the autoclave. The distilled or demineralised water not used during the sterilization will remain in the autoclave, but this will not be harmful for the operation of the autoclave.

Adjusting

In order to check that the autoclave is set up properly, a graduated measuring beaker is provided. The autoclave has been set up properly when: for Type 15: 280 ml , or for Types 17 and 23: 300 ml distilled / demineralised water has been filled into the empty autoclave from the front and the water can be seen in the inspection cut-away (13). If necessary, the feet at the front of the autoclave (11) should be adjusted until the water is visible.

2.2 Filling the storage container

To fill the storage container, remove the housing lid (1) on top of the autoclave and take off the lid of the storage container underneath it (see Sections 1.1 and 8.2).

The storage container should be filled with approximately 3 litres of demineralised/distilled water. Care should be taken to ensure that the water does not exceed the "MAX" level (C, 8.2), because the opening for the cooling loop (E) of flow nozzle at (B) must not be covered with water, otherwise it will not be possible to reach the necessary pressure. In order to condense the steam and to avoid excess steam emission and the resultant increased use of distilled / demineralised water, the cooling loop (E) of the flow injector (B) and the pressure release (G) in the storage container should be well covered with water. The distilled / demineralised water should therefore be refilled at regular intervals, or even better, residual water should be drained away by opening the drainage tap (12) and the autoclave filled up with new distilled / demineralised water.

2.3 VDE - regulations

Under current VDE-regulations, this autoclave is not suited for use in areas where there are risks of explosion.

The autoclave must only be serviced and repaired by MELAG or by its authorised representatives (specialist dealers or customer services).

Warning !
The door frame, the autoclave chamber and the sterilized items are hot during and after the sterilization!

3 For each sterilization

3.1 Items to be sterilized

Tray rack assembly

In order to prevent the items being sterilized from overheating as a result of the radiated heat in the chamber, the autoclave must not be operated without using the enclosed MELAG tray rack assembly. Trays or racks on which the items to be sterilized are laid, or containers (with or without lid) must be perforated (as described in detail in the BGA-Guidelines "Carrying out Sterilization 2.1.4.a Containers, as Annex to Section 7.1 of the "*Richtlinie für die Erkennung, Verhütung und Bekämpfung von Krankenhausinfektionen*").

Sterilization wrapping

The items to be sterilized can be sealed in a transparent foil packaging, e.g. MELA*fol*® (one side paper, one side foil). The paper side of the packaging must face downwards. These sealed items must not be placed one on top of another on a tray. In order to improve drying, it is advisable to using a MELAG drying rack for the items in transparent packaging (MELAG Art. No. 283; fits only in Type 23). When sealing items, ensure that the seal itself is in accordance with German standard DIN 58953 Part 7 and has a minimum width of 8 mm. The MELAG foil sealing machine MELA*seal*®101 produces a seal that is 10 mm wide.

Sterilizing plastic articles

When sterilizing plastic articles pay careful attention to the maximum sterilization temperature specified by the manufacturer. Direct contact of the products with the tray rack assembly should be avoided, since the items being sterilized may be damaged by the heat given off by the autoclave.

Plastic articles such as pipette tips should always be placed on the middle tray if possible. it is advisable to place them on a sheet of filter paper in order to avoid direct contact with the tray or container.

Liquids

These autoclaves are **not** suitable for the sterilization of liquids!

3.2 Sterilization process

1. Max. pressure indicator

Reset the red maximum pressure indicator of the pressure gauge (3) to "0".

2. Loading

Trays or containers should be filled loosely with the instruments to be sterilized and inserted. Textiles should not be folded tightly or pressed into the sterilization containers. The maximum load for textiles must not be exceeded.

3. Pressure selection (only type 17 and type 23)

Depending on the type of load, the pressure selection (10) should be set to 1 bar or 2 bar (1 bar =120°C) is for rubber, textiles, etc.; 2 bar (=134°C) is for metal, glass, etc.; type 15 has only the 2 bar program).

4. Filling with water

The "water inlet" switch (9) is then set to "I". When water is visible in the inspection cut-out (13) return the switch to the "0" setting.

5. Timer switch

The timer switch (8) is set to correspond to the selected pressure (10) at either the 30 minutes or 50 minutes mark (Type 15: only 30 minutes). When the power is then switched on, the signal lamps (5) and (7) will light up. The electronic temperature regulator controls by means of the heating the temperature and the pressure; the white signal lamp "Heating" (7) goes on and off correspondingly.

6. Close the door tightly

Important! Only close the door after the timer switch has been set.

7. End of the sterilization

At the end of the time set with the timer (8) the power will be switched off and the solenoid valve for the "Rapid pressure release" opens automatically. The signal lamps (5) and (7) go out.

Warning! Do not open the door until the moving pressure gauge indicator has returned to "0".

8. Drying

In order to be able to cope with difficult drying tasks, the autoclave has a switch for "Drying" (4). It is possible to preselect the drying option before beginning the sterilization or to select it after the automatic rapid pressure release. The "Power" signal lamp will be on permanently and the "Heating" signal lamp will go on and off at intervals in order to maintain a temperature of approx. 120°C in the autoclave chamber until the "Drying" switch is returned to the "0" setting (the "Power" and "Heating" signal lamps will go out). For best drying results the door should be kept slightly open.

Warning! The chamber, door, trays, and sterilized instruments are hot! During the drying phase the thermometer will not display the temperature in the autoclave chamber.

3.3 Process control

The red indicator on the pressure gauge (3) shows the maximum pressure reading during the sterilization cycle, which should correspond to the pressure selected with the switch (10).

3.4 Program termination

A program can be terminated at any time. Proceed as follows:

1. Turn timer switch (8) to "0"
2. Turn "Drying" switch (4) to "0" (if drying had been selected)
3. Observe the pressure gauge (3) until the display falls to "0"
4. The door can now be opened.

3.5 Removing dry loads

A way of ensuring that the load removed from the autoclave is dry and ready for use is to set "Drying" switch (4) to "I" immediately after the automatic release of pressure (pressure gauge reading "0"). The "Power" signal lamp (5) will be on continuously and the "Heating" signal lamp will go on and off at regular intervals. The door of the autoclave chamber should be kept ajar. The drying can go on as long as required for the load in question. To end the drying phase the "Drying" switch should be returned to "0". The "Power" and "Heating" signal lamps go out.

Warning! Door, chamber and load are hot!

During the drying the thermometer will not display the temperature in the autoclave chamber.

Filter paper

It has proved helpful to place a layer of filter paper in the tray on which to lay the instruments to be sterilized, and then to cover these with another sheet of filter paper.

Cellulose or gauze

Soaked cellulose or gauze should not be used to lay instruments on or to cover them, because the steam can dissolve out substances which can leave spots and discolorations on the items being sterilized.

3.6 Sterilization frequency

The MELAG autoclaves can be used for approximately 8 sterilization cycles every day. This large number of cycles is possible because of the MELAG system, which only involves a relatively small amount of distilled / demineralised water being turned into steam for the sterilization and then condensed again afterwards.

Breaks between cycles

A sterilization cycle is completed when the timer has returned to "O" or the "Drying" switch (4) has been switched off. It is important to allow a break of at least 30 minutes before starting the next sterilization cycle. Otherwise the residual heat in the thick-walled autoclave chamber can lead to the thermostat switching off too soon during the following sterilization cycle so that the desired pressure will not be reached, or will not be maintained for a sufficiently long period.

4 Further information about sterilization

4.1 Duration of sterilization (complete process)

Running time

at 2 bar (134°C) : 30 min

at 1 bar (120°C) : 50 min

Once the switch (8) has been set to 1 bar or 2 bar, the sterilization proceeds automatically until the rapid pressure release, without any need for further manual intervention. For the autoclave type 15, which is fixed at 2 bar (134°C), the running time is 30 minutes.

Operational phases

The overall running time for a sterilization cycle consists of various phases: a heating phase, ventilation phase, rise and equalisation phases, as well as the sterilization proper and an extra safety period which together make up the sterilization phase.

Autoclave temperature

The specified operating times must always be adhered to, whether starting with a cold or a hot autoclave, in order to ensure that the chamber is filled with saturated steam. Air is expelled through the flow nozzle (B) and the time required for this is constant, even if the autoclave is not starting from cold.

Drying time and temperature

Drying time: as required

Temperature: approx. 120°C

After operating the "Drying" switch (4) the autoclave chamber is heated to 120°C, and this temperature is maintained until the drying is switched off again.

Warning! The chamber, door, trays, and sterilized instruments are hot!

4.2 Use of distilled or demineralised water

Quality requirements

For the steam sterilization it is important to use either distilled or demineralised water of sufficient quality.

A guideline for the preferred water quality is given in the following table which lists values in accordance with the European CEN Standard EN 285.

Conductivity	**≤**	**15**	**µS/cm*)**
Evaporation residues	≤	10	mg/l
Silicone , SiO_2	≤	1	mg/l
Iron	≤	0,2	mg/l
Cadmium	≤	0,005	mg/l
Lead	≤	0,05	mg/l
Other heavy metals	≤	0,1	mg/l
Chloride	≤	2	mg/l
Phosphate	≤	0,5	mg/l
pH - value	5 bis 7		
Appearance	colourless, clear, without residues		
Hardness	≤	0,02	mmol/l

*) µS/cm = Mikro Siemens per centimeter

However, for the Type 15, 17 and 23 autoclaves it is also sufficient to use **demineralised water in accordance with VDE 510**, as long as the VDE requirements are strictly adhered to (conductivity on demineralisation ≤ 10 µS/cm*), as well as before use ≤ 30 µS/cm*). Specifications for the pH-value are identical with EN 285, and for evaporation residues similar).

Demineralised water meeting the specifications of VDE 510 or a local equivalent is widely available. The quality of the water (compliance with VDE 510) must be specifically mentioned on the label.

Problems with impure water

If water is used which is not sufficiently pure this can lead to the formation of scaling in the steam piping, on valves, and in the flow nozzle, and as a result the autoclave will no longer operate properly. The use of aggressive water (pH < 5 or > 7) can result in corrosion and other harmful effects in the autoclave.

Formation of surface marks

The extent to which marks are formed on the surface of the instruments being sterilized depends also on the quality of the water used for steam generation.

Use only demineralised or distilled water for the steam sterilization.

4.2.1 Consumption

The amount of water in the storage container is reduced for every sterilization by the amount which is not recovered but escapes as steam. The extent of such losses is dependent on various factors.

Frequency of sterilization

If sterilizations are carried out very frequently, this can result in the distilled / demineralised water in the storage container becoming too warm to cool the steam from the autoclave chamber sufficiently for this to condense, and some steam will escape from the storage container.

Cooling coils

If the storage container has not been refilled with distilled / demineralised water for a long time, the water level may drop so low that the cooling coils (E,G) are not covered, and the outgoing steam will again not condense properly.

4.2.2 Exchanging the water in the storage container

If impurities are found

If there are impurities in the water in the storage container this is usually because the instruments have not been cleaned properly before sterilization.

It is important to check at regular intervals that the water is still clean. If there are signs of impurities, cloudiness, or if a surface film has formed or there is scaling on the walls and base of the storage container, then it is essential that the distilled / demineralised water be exchanged. The storage container must be cleaned before it is refilled. Fatty deposits can be removed using small amounts of a mild detergent cleaner and warm water and a soft-bristled bottle-brush. Then rinse out the storage container with clear water (on the water quality see Section 4.2).

4.2.3 Emptying the storage container

After opening the screw stopper of the outlet (12) by turning anti-clockwise, the water to be discarded can be allowed to run out into a suitable container.

Then replace the screw stopper of the water outlet and refill the storage container up to the "MAX" level (C) with approximately 3 litres of unused demineralised or distilled water.

5 Notes on operating malfunctions

The following notes on operating malfunctions are intended to help with repairing small defects or to describe problems in more detail to the authorised dealer / depot / customer services.

5.1 Low pressure reading from the pressure gauge

After a sterilization, if the red maximum pressure indicator does not show at least the pressure corresponding to the program that has been selected, then the following points should be checked.

Connection to the power supply

Is the autoclave connected to the mains power supply, and is the power switched on? When the timer is turned on the "Power" and "Heating" signal lamps should light up.

Pressure gauge

Is the pressure gauge (3) working properly? If the thermometer (6) is showing a temperature that is appropriate for the selected program, but the pressure gauge is not showing any pressure reading, then the pressure gauge is probably defective. In order to generate dry steam, at a temperature of 134°C there should be a pressure of 2.0 bar. Otherwise, the pressure gauge may need to be exchanged.

5.2 Pressure reading from pressure gauge too high

"Pressure swing"

The most common cause of excessive pressure in the autoclave is the "pressure swing". This usually happens if the autoclave is still very hot from a previous sterilization and is then restarted with only a small load. This combination means that the heating causes the pressure to rise very rapidly so that the required pressure is reached before it has been physically possible to expel all the air from the chamber. This results in an additional increase in pressure until the overall pressure rises above the selected sterilization pressure. The steam in the chamber is not saturated, and the values shown on the pressure gauge (3) and thermometer (6) deviate from the values for the production of saturated steam. However, because all MELAG autoclaves are fitted with an electronic temperature control, the selected sterilization temperature will still not be exceeded and the "pressure swing" will balance itself out before the end of the sterilization period by the continued exclusion of air. This can be determined by checking that the reading of the pressure gauge (white indicator) 5 minutes before the end of the program (2 bar program) is within the selected pressure range.

Max. pressure indicator is sticking

If the red maximum pressure indicator gets stuck, it can obstruct the moving indicator of the pressure gauge (3). If the max. pressure indicator then suddenly becomes unstuck, the momentum can send it some way past the correct pressure reading. In this case it might, for example, appear to indicate that there had been a maximum pressure of 4.5 bar, even though the pressure had in fact been normal throughout the sterilization. This can be checked by observing the pressure gauge during a sterilization cycle.

Clogging of the flow nozzle

If instruments are not prepared carefully before sterilization, this can result in partial or total blockage of the flow nozzle (B). During the heating up phase air is expelled through this nozzle. If it is totally or partially blocked then the air that remains in the autoclave chamber exerts an additional partial pressure during the sterilization phase. The flow nozzle can be unblocked carefully using a wire or similar instrument with a diameter of less than 0.5 mm. An indicator of a clogged flow nozzle and residual air in the autoclave chamber is a thermometer reading of less than 134 °C for a pressure gauge reading of 2 bar or higher.

5.3 Pressure reading too low

Load

If the autoclave has a load that is appreciably above the maximum load specified in the technical data section (1.2) then it will take longer to heat up and as a result there will not be sufficient time for the actual sterilization process, or the necessary pressure may not be reached at all. The specified maximum load (see Section 1.2) should therefore never be exceeded.

Breaks between sterilization

If the break between sterilization cycles is less than 30 minutes, then too much heat will be retained in the autoclave and the heater will switch off too early, so that the necessary pressure will either not be reached, or will not be maintained throughout the sterilization phase.

Safety valve

Is the safety valve (D) leaking? The safety valve is located in the storage container underneath the "Max" water level marker. If it is already releasing steam when the pressure gauge shows 2.5 bar or less, then the safety valve should be replaced.

Timer knob

If the timer knob (8) is turned too quickly and forced past the stopper then this can lead to the knob rotating relative to its axis. In this case the timer will no longer point to the correct time. Does the knob point exactly to the "0" when the autoclave is switched off? To adjust this, lift the cap on the timer knob, and loosen the fastening nut slightly (do not remove it!). Reposition the knob, retighten the nut and replace the cap.

5.4 Overheating in the Chamber

Overheating is almost always a result of insufficient water in the autoclave chamber.

If your autoclave overheats:

- Switch the power off
- Turn the timer knob to "0"
- Open the door and leave it to cool for half-an-hour

Before starting operations again check for the following possible causes and take appropriate steps.

Flow nozzle

If instruments are not prepared properly for the sterilization then the distilled / demineralised water and thus also the steam will contain impurities and after frequent use of the autoclave or after a long period, the flow nozzle (B) will become worn by the passage of the solid particles and its diameter will be increased. This can lead to an excessive loss of steam. The flow nozzle must be replaced.

Solenoid valves

Soiling as a result of inadequate preparation of instruments can leads to leaks through the solenoid valves for the water inlet and the rapid pressure release.

Rapid pressure release

If there is a leak of the solenoid valve for the rapid pressure release then during the pressure phase steam or water droplets form at the end of the cooling loop for the rapid pressure release (G). If a lot of steam or water is emitted then the solenoid valve is defective, or dirt particles have collected on the seal of the solenoid valve which the maintenance technician will be able to remove.

Water inlet

If there is a leak of the solenoid valve for the water inlet then during the phase of pressure increase air bubbles will be seen forming at the filter of the water inlet (F). It is often possible to remove a dirt particle from the seal of the solenoid valve that is responsible for causing the leak as follows: After reaching the maximum possible pressure, the switch for the water inlet (9) can be turned on and the steam flowing through the solenoid valve will blow the seal clean. This leads to a loss of pressure in the chamber. It is very important that after the switch has been returned to the "0" position, the timer is also turned back to "0". Otherwise the shortage of water or of steam in the chamber can lead to overheating.

Timer knob

The timer knob (8) no longer has the correct alignment (see Section 5.3).

Textiles

Textiles retain large quantities of condensed steam, so that when they are being sterilized it is very important to ensure that the autoclave is not overloaded (for maximum load, see above, 1.2).

Safety valve

The safety valve is located in the storage container under the MAX water level marker. If it already releases steam when the pressure gauge is reading less than 2.5 bar then it must be exchanged.

5.5 Residual water in the chamber

A small amount of residual water in the autoclave chamber is unavoidable. As the chamber cools down, steam in it condenses on those parts which cool first (door, chamber floor).

Larger amounts of residual water can have various causes:

Chamber filter

After completion of the operating cycle a small amount of water remains in all MELAG autoclaves, which serves during the sterilization to prevent overheating of the steel chamber vessel. At the end of the time set for the cycle using the timer switch, the water will be pressed down with the outflowing steam back into the water storage container. A filter is installed at the outlet to prevent dirt and impurities from entering into the piping system, and if this becomes clogged then a residual amount of water will remain in the chamber.

Solenoid valve - Water inlet

If instruments have not been prepared properly then dirt and impurities can prevent the solenoid valve of the water inlet from closing properly so that small drops of water still enter the chamber from the storage container after the sterilization. In this case, this is not actually residual water. This can be checked by removing the tray rack assembly and wiping the chamber out with a dry cloth. It should still be dry after some hours. If it is wet again, then the solenoid valve should be cleaned (see also 5.4. "Water inlet").

5.6 Signal lamp 'Power' stays on continuously

The "Power" signal lamp (5) lights continuously, and the "Heating" signal lamp (7) lights at intervals. The pressure gauge shows a pressure of no more than 0.3 bar with the door closed after the timer switch has switched off (8). Check the "Drying" switch (4) and if appropriate switch it to "0". The pressure should then decline, and both signal lamps go out. The door can then be opened.

5.7 Signal lamp 'Power' doesn't light up

The "Power" signal lamp (5) does not light up although there is a power supply to the mains socket. The autoclave does not work and there are no displays. This can occur if one of the screw-in fuses (on the rear-side of the autoclave) has blown as a result of a short-circuit in the autoclave. As this malfunction can indicate a serious fault, you should inform customer services.

6 Safety instructions

After opening the door of the autoclave do not touch exposed metal parts. **These may be hot and could cause burns!** To remove and handle hot trays you should use a tray lifter, and for other sterilization containers use suitable hand protection.

Empty the water storage container before any transport, do not tilt the autoclave if it is filled with water.

Do not open the door until the pressure in the autoclave has been equalised (pressure gauge display shows "0"): Small amounts of residual steam may be released from the autoclave chamber when the door is opened.

The autoclave may only be serviced by persons authorised by MELAG, using original spare parts. Before opening the enclosure of the autoclave ensure that the plug is removed from the mains power socket.

This autoclave is not suitable for the sterilization of liquids.

7 Taking the autoclave out of operation/Transport/Re-installation

When taking the autoclave out of operation for a longer period or before transportation of the autoclave proceed as follows:

- Disconnect from the mains power supply and allow the autoclave to cool down
- Empty the water from the storage container by opening the "Outlet" valve (12).
- If the autoclave is to be transported with tray rack and/or trays in place, then place a foam sheet or similar protection between the door and the pressure chamber to avoid scratching and other damage.
- After moving it to another location or after repairs, then reinstall the autoclave in accordance with the "installation" procedure (see above).

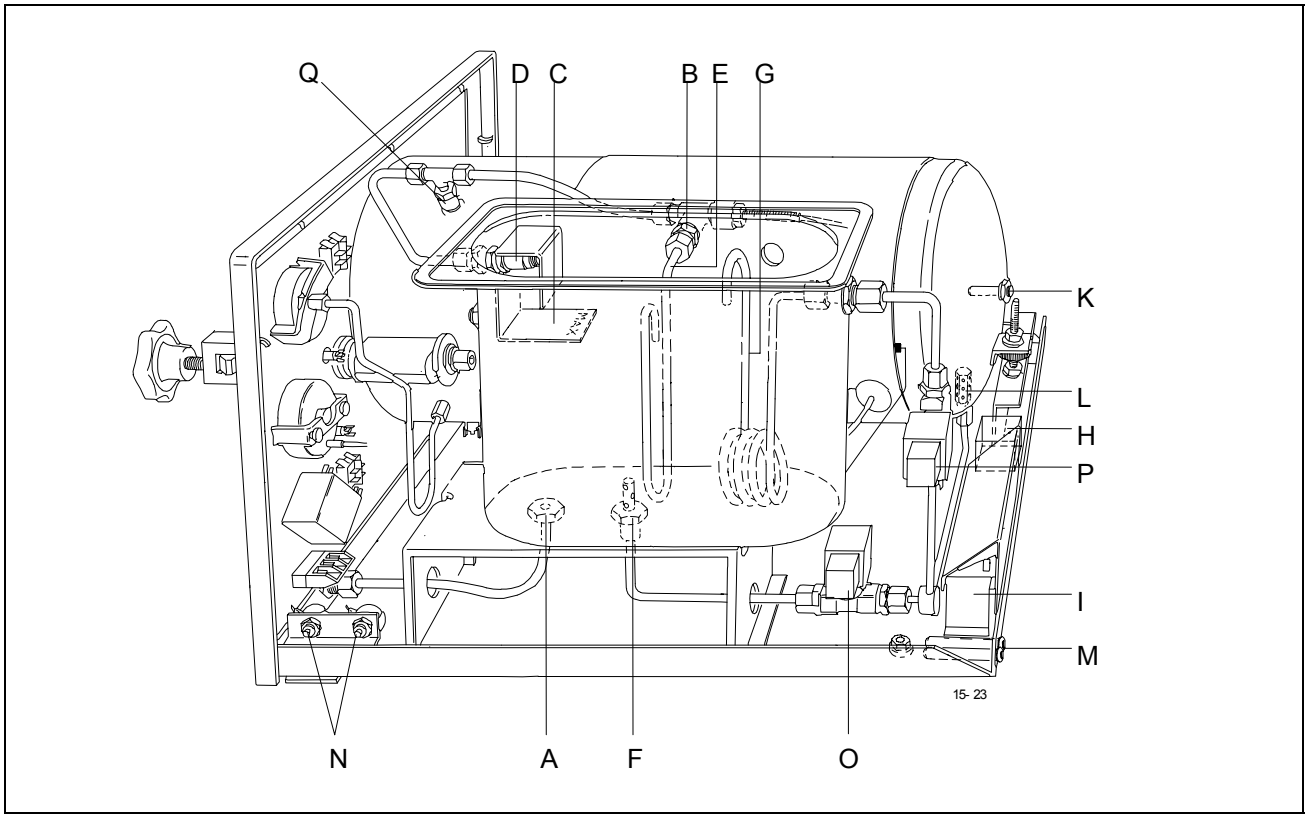
Note! To avoid damage during transport use the original packing for the autoclave.

8 Annex

8.1 Spare parts

Art.-no.	Name of spare part
34125	Flow nozzle (M6, width 8 mm)
16005	Safety valve (calibrated)
32150	Door gasket for type 15
32670	Door gasket for type 17
34150	Door gasket for type 23
34010	Filter for pressure chamber
33890	Timer switch
34165	Pressure gauge
40100	Thermometer
29560	Solenoid for solenoid valve
587400	Overheating protection switch (mounted on pressure chamber)
34365	Door locking latch (always exchange latch and star grip knob together)
34360	Door star grip knob
12690	Mains fuse 12,5A/T (2x)

8.2 Inside the autoclave



A	Drainage outlet of storage container	I	Control electronics
B	Flow nozzle	K	NTC Temperature sensor for control electronics
C	Water level ("MAX")	L	filter for pressure chamber
D	Safety valve	M	Mains-fuse
E	Cooling coil	N	Potentiometer
F	Impurity filter (for the water inlet)	O	Solenoid valve - water inlet
G	Cooling loop (of rapid pressure release)	P	Solenoid valve pressure release
H	Capillary tube controller „drying“	Q	Flow line filter(screwed in from inside)